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FLEXIBLE CONTACT CONNECTOR

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Patent Application No. 60/455,180 filed March 17, 2003, which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Technical Field

This invention relates generally to electric powered models, for example, model trains, and more particularly to a flexible contact connector for coupling a pair of models together.

2. Discussion of the Related Art

It is known to provide an electric powered model, such as a model train, that draws its power from rails of a track, which is in turn powered by a power source. In a particular model train system, a so-called three rail track is provided wherein power, such as AC power, is applied across the rails of the track. The center or middle track rail is coupled to the "hot" or power terminal of the power source, while the ground or neutral terminal is coupled to the outside track rail.

A locomotive model train or the like draws its power from the track rails. To complete an electric circuit, the locomotive must make good, electrical contact with both the center track rail and the outside track rail. It should be noted that there are a wide variety of locomotive configurations, for example, some with no trucks and/or with "rubber" covered wheels to improve traction but which provides an electrical insulating effect. In any event, through a variety of configurations, the number of electricity conducting axles may be reduced, perhaps to only one. In such circumstance, when the locomotive traverses a section of track that is "dead" due to an open circuit condition or due to dirt or other electrical insulating material on the outside ("ground" or neutral) track rail, the electric powered locomotive may have its electrical circuit "broken" which may cause the electric motor to

discontinue torque production momentarily until the electric powering circuit is re-established.

It is also known to couple electrical signals between the locomotive and a tender using wires from each terminating in complementary connectors.

There are, however, numerous shortcomings with respect existing mechanical and electrical coupling arrangements. For instance, existing arrangements require separate mechanical and electrical connections to couple a pair of train cars together, such as, for example purposes only, a locomotive to a tender or two tenders together. Additionally, extra hard wire connections are often times required in order to electrically connect the circuit(s) of the train cars so that signals such as power, ground and other similar electric pulses can be transmitted therebetween.

Accordingly, a need exists for a coupling means that minimizes and/or eliminates one or more of the above identified deficiencies.

SUMMARY OF THE INVENTION

The invention provides an easy car-to-car connection without the need for an extra hardwire connection(s) to transmit signals, such as power, ground or other electrical signals between two or more electric toy train cars.

Flexible conductive material on one train car (such as a locomotive or a tender) makes contact with corresponding conductive material on the adjacent, next train car completing an electrical/electronic circuit(s). Once two or more train cars are coupled together, the flexible contact(s) between the train cars is such that the electronic circuit(s) will remain in contact through typical use until the cars are uncoupled. In one embodiment, a locomotive obtains an electrical connection to "ground" through this flexible connector to an adjacent train car, which in turn gets ground from its own wheel/axle contacts with the outside track rail. This arrangement improves the robustness of operation, even for locomotives having a minimal configuration for connecting to the ground track rail, for example, a locomotive with no trucks and all but one axle is rubberized for traction. In still a further embodiment, the flexible connector includes an aperture to allow IR communication between the locomotive

and the train car. Electrical signals other than ground may be communicated by the inventive connection, including but not limited to power and/or control signals. In addition, the invention may also be used in DC powered systems.

Accordingly, a flexible connector is presented. The flexible connector includes a first and a second coupling member associated with a first and a second model train car, respectively, wherein the second coupling member is configured for engagement with the first coupling member. The flexible connector further includes a first layer of flexible electrically conductive material connected to a first circuit and disposed upon the surface of the first coupling member. The flexible connector still further includes a second layer of flexible electrically conductive material connected to a second circuit and disposed upon the surface of the second coupling member. This arrangement allows for the first and second model train cars to be mechanically and electrically connected when the first and second coupling members are engaged with each other.

A method of powering an electric train is also provided.

DESCRIPTION OF DRAWINGS

Figure 1A is a side view of an exemplary embodiment of a flexible contact connector in accordance with the present invention;

Figure 1B is a top view of a portion of the flexible contact connector of Figure 1 along the lines 1B-1B in Figure 1;

Figure 1C is front view of a portion of the flexible contact connector of Figure 1 along the lines 1C-1C in Figure 1;

Figure 2 is a first perspective view of the flexible contact connector of Figure 1;

Figure 3 is a second perspective view of the flexible contact connector of Figure 1;

Figure 4 is a third perspective view of the flexible contact connector of Figure 1;

Figure 5 is a fourth perspective view of the flexible contact connector of Figure 1;

Figure 6 is a fifth perspective view of the flexible contact connector of Figure 1;

Figure 7 is a sixth perspective view of the flexible contact connector of Figure 1;

Figure 8 is a seventh perspective view of the flexible contact connector of Figure 1;

Figure 9 is a first perspective view of an alternate embodiment of a flexible contact connector in accordance with the present invention;

Figure 10 is second perspective view of the flexible contact connector of Figure 9;

Figure 11 is a third perspective view of the flexible contact connector of Figure 9;

Figure 12 is a fourth perspective view of the flexible contact connector of Figure 9;

Figure 13 is a fifth perspective view of the flexible contact connector of Figure 9;

Figure 14 is a side view of the flexible contact connector of Figure 9;

Figure 15 is a sixth perspective view of the flexible contact connector of Figure 9; and

Figure 16 is a block diagram of a method of powering an electric train in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings wherein like reference numerals are used to identify identical components in the various views, Figure 1A shows a first exemplary embodiment of a flexible contact connector, designated as reference numeral 9. Connector 9 provides an electrical and mechanical connection between a first model train car, such as a locomotive car 10, and a second model train car, such as a tender car 12. It should be noted that while connector 9 can be used to couple a locomotive and tender together, connector 9 is not limited to this configuration. In reality, connector 9 can be used to couple, for example, two locomotives, two tenders, etc. together. Figure 1A further shows a first coupling member 14 associated with locomotive 10, and a second coupling member 16 associated with tender car 12. First and second coupling members 14 and 16 shown in Figure 1A are of the drawbar type.

First coupling member 14 includes a horizontal portion 14a having a top and a bottom side, and a vertical portion 14b having an inner and an outer side. Vertical portion 14b is located at a distal end of horizontal portion 14a, and is configured to be perpendicular therewith so as to form a generally J-shaped drawbar. First coupling member 14 further includes a layer of electrically conductive material 18 disposed on the upper and the outer sides of portions 14a and 14b, respectively. First coupling member 14 may further include a layer of electrically insulating material 20 disposed between conductive layer 18 and the upper and outer sides of coupling member 14, as shown. Electrically conductive material 18 and electrically insulating material 20 may comprise conventional materials known in the art. For example, material 18 may comprise copper or its alloys.

Second coupling member 16 comprises a horizontal portion 16a having a top and a bottom side, and further has a through-aperture 16b on a distal end thereof (best shown in Figure 1B). Portion 14b and aperture 16b are configured in a complementary manner in both size and shape so that portion 14b may be disposed in aperture 16b, as shown in Figure 1A. Second coupling member 16 further includes a second layer of flexible, resilient, electrically conductive material 22 disposed on the bottom side thereof. Conductive layer 22 includes a straight, horizontally-disposed portion 22a that extends into an arcuate portion 22b thereby forming a generally J-shaped item 22. Conductive layer 22 may comprise phosphor bronze material for its suitability with respect to springiness, and ability for elastic deformation (*i.e.*, that will retain its shape). Second coupling member 16 may still further include a second layer of electrically insulating material 23 disposed between conductive material 22 and the bottom side of second coupling member 16, as shown.

The arcuate portion 22b of conductive layer 22 that projects into aperture 16b is such that electrical contact is made at 25 between the layers of electrically conducting material 18 and 22. Connection point 25 provides electrical connectivity between a circuit 24 (*e.g.*, a ground input for a motor drive or motor input terminal) and a circuit 26 (*e.g.*, a coupling to the ground track rail such as a truck axle via a conductive wheel). Of course, other power and/or control signals may be passed via flexible connection 9 relating to various electronics (*e.g.*, circuits 24 and 26).

With reference to Figures 1A and 1C, first coupling member 14, and portion 14b in particular, has a second through aperture 28 therein suitable for use in an alternate embodiment. Aperture 28 is configured to allow transmission of infrared (IR) signals from an IR transmitter (not shown) associated with locomotive 10 to an IR receiver (not shown) associated with tender 12. Messages can be carried by the IR transmitter/receiver, as known.

With reference to Figures 2-8, flexible connector 9 can be configured so that layers of conductive material 18 and 22 include a plurality of electrically conductive elements. For example, Figure 2 shows a four conducting element arrangement. It should be noted that this four conducting element arrangement is for exemplary purposes only and is not meant to be limiting in nature. In reality, conductive material 18 and 22 can be configured with any number of conducting elements. In any event, in this illustrated four conducting element arrangement, first coupling member 14 includes a four conducting elements 18_1, 18_2, 18_3, and 18_4. Second coupling element 16 includes a corresponding four conducting elements 22_1, 22_2, 22_3, and 22_4. When first and second coupling members 14 and 16 are engaged, conductive portions 18_1, 18_2, 18_3, and 18_4 engage portions 22_1, 22_2, 22_3, and 22_4, respectively, thereby completing four "circuits" between locomotive 10 and tender 12 at connection point 25. Accordingly, when first and second coupling members 14 and 16 are engaged, train cars 10 and 12 (*i.e.*, locomotive and tender) are both mechanically and electrically coupled together using one single coupling means without any extra hard wire connections or additional coupling mechanisms.

Figures 9-15 show an alternate embodiment of a flexible contact connector, designated 9a. Unless stated to the contrary, all disclosure with respect to flexible connector applies with equal force to flexible connector 9a.

With respect to Figures 9-15, this illustrated embodiment of flexible connector 9a is of an interlocking C-shape type, but also embodies the same principles of the first embodiment, namely, of flexible connector 9. Figure 9 shows flexible connector 9a comprising C-shaped first and second coupling members 29a and 29b interlocked in an engaged position. As with the exemplary embodiment discussed above, first coupling member 29a includes a first layer of electrically conducting material 30 disposed on a portion of the surface of first coupling member 29a. Coupling member 29a may also include a first

layer of insulating material 31 disposed between the surface of coupling member 29a and conductive material 30. Similarly, coupling member 29b includes a second layer of conductive material 32 disposed on a portion of the surface of coupling member 29b. Coupling member 29b may also include a second layer of insulating material 33 disposed between the surface of coupling member 29b and conductive layer 32.

With respect to Figure 10, connector 9a is shown wherein first and second coupling members 29a and 29b are disengaged. When coupling members 29a and 29b are disengaged, train cars 10 and 12 are neither mechanically nor electrically coupled together. However, as shown in Figure 9, when coupling members 29a and 29b are interlocked so as to be engaged with each other, train cars 10 and 12 are both mechanically and electrically connected without the necessity of additional wiring or other coupling mechanisms.

As with the exemplary embodiment illustrated in Figures 1-8, first and second layers of conductive material 30 and 32 of flexible connector 9a may also be configured with a plurality of electrically conducting elements. With reference to Figure 11, a four conducting element arrangement is shown. As with the exemplary embodiment discussed above, this arrangement is for exemplary purposes only and not meant to be limiting in nature. In actuality, layers of conductive material 30 and 32 can be configured with any given number of conducting elements. In any event, in the four conducting element arrangement illustrated in Figure 11, conductive elements 30_1 through 30_4 are in engagement with a corresponding plurality of conductive portions 32_1 through 32_4 when first and second coupling portions 29a and 29b are engaged. This arrangement, in-effect, completes four individual electric circuits between train cars 10 and 12.

Note, in the first and second embodiments, each of the plurality of conductive elements in first and second layers of conductive material 30 and 32 are separated from each other to provide distinct electrical circuits. Intervening portions of electrically insulating material may also be disposed in between electrical elements to further enhance the electrical distinctness.

With respect to Figures 12-15, the progression engaging first and second coupling members 29a and 29b is shown. In Figures 12 and 13, coupling portions 29a and 29b are in a

disengaged relationship. In Figure 14, coupling members 29a and 29b are in a partially engaged relationship. In Figure 15, coupling members 29a and 29b are in an engaged relationship.

Accordingly, with respect to Figures 1-15, a flexible contact connector in accordance with the present invention includes a first and second coupling member attached to a first and second train car, respectively. A first layer of conductive material is disposed on the surface of the first coupling member, and a second layer of conductive material is disposed on the surface of the second coupling member. When the first and second coupling members are placed in engagement, the first and second layers of conductive material also engage, thereby creating both a mechanical and electrical connection between the first and second train cars with a single coupling mechanism.

With respect to Figure 16, a method of powering an electric train is shown. Step 34 comprises providing a power source. In an exemplary embodiment, the power source applies power across the rails of a three rail track, wherein the center rail is connected to the "hot" or power terminal of the power source, and the ground or neutral terminal is connected to the outside rail of the track. It should be noted, however, that this three rail track configuration is provided for exemplary purposes only and is not meant to be limiting in nature. In actuality, the inventive connector and method set forth herein can be used with other track configurations, such as, for example, two rail track systems.

Step 36 comprises providing a plurality of model train cars wherein at least one of the train cars is in electrical contact with said power source (*i.e.*, via the center rail of the track). Step 36 further includes providing a plurality of model train cars wherein a first car has a first coupling member attached to its rear end, and the second car has a second coupling member attached to its front end so as to allow for the first and second cars to be connected together when the first and second coupling members are engaged (in step 40 discussed below). Similarly, the second car is further configured to have a first coupling member attached to its rear end, and a third car is configured to have a second coupling member attached to its front end to allow the second and third cars to be connected, and so on an so forth.

Step 36 further includes substeps 36a and 36b. Substep 36a comprises disposing a first and second layer of electrically conductive material on the surface of the first and second coupling members, respectively, so as to create an electrical connection between the first and second train cars, in addition to the mechanical connection, when the first and second coupling members are engaged. This conductive material may be comprised of one conducting element or a plurality of separate and distinct conducting elements. Substep 36b entails disposing a first and second layer of insulating material between the first and second conductive layers and the surface of the first and second coupling members, respectively.

Step 38 includes connecting the first layer of conductive material to a first circuit and the second layer of conductive material to a second circuit. In a preferred embodiment, the first layer of conductive material is connected to the power source.

Finally, step 40 provides for coupling two of the plurality of train cars together to form a train using a single connector that is operative to both mechanically and electrically connect each train car to the next adjacent train car in the train.

Accordingly, in operation, the inventive connector 9 allows two-way communication between a pair of train cars, such as a locomotive and a tender, for example, without the need of secondary physical connectors, wires, or other devices to couple the cars together. Connector 9 can be used between two intelligent cars allowing communication and/or control of physical devices such as, for example purposes only, lights, sound and movement.

For example, a locomotive receives a signal to trigger the lights and/or sounds associated with the train cars. The locomotive generates and/or transmits a signal to a lighting circuit and/or sound circuit on a tender car coupled to the locomotive by way of connector 9, thereby causing the activation or deactivation of either/or the lights and sound of the tender car. Similarly, connector 9 can be used to transfer some or all of the electrical power needed to operate model trains. A locomotive is in electrical contact with the power source of the electrical system and transfers some or all of this power to the vehicles coupled to it through connector 9 to thereby run motors or other electrical devices located on the train car coupled to the locomotive. It should be noted that these examples are provided for

exemplary purposes only and are in no way meant to be limiting in nature. In reality, there are a number of other applications for this inventive connector.

While only those embodiments set forth above have been described in detail, other configurations and embodiments for the present invention exist that are within the spirit and scope of the invention.